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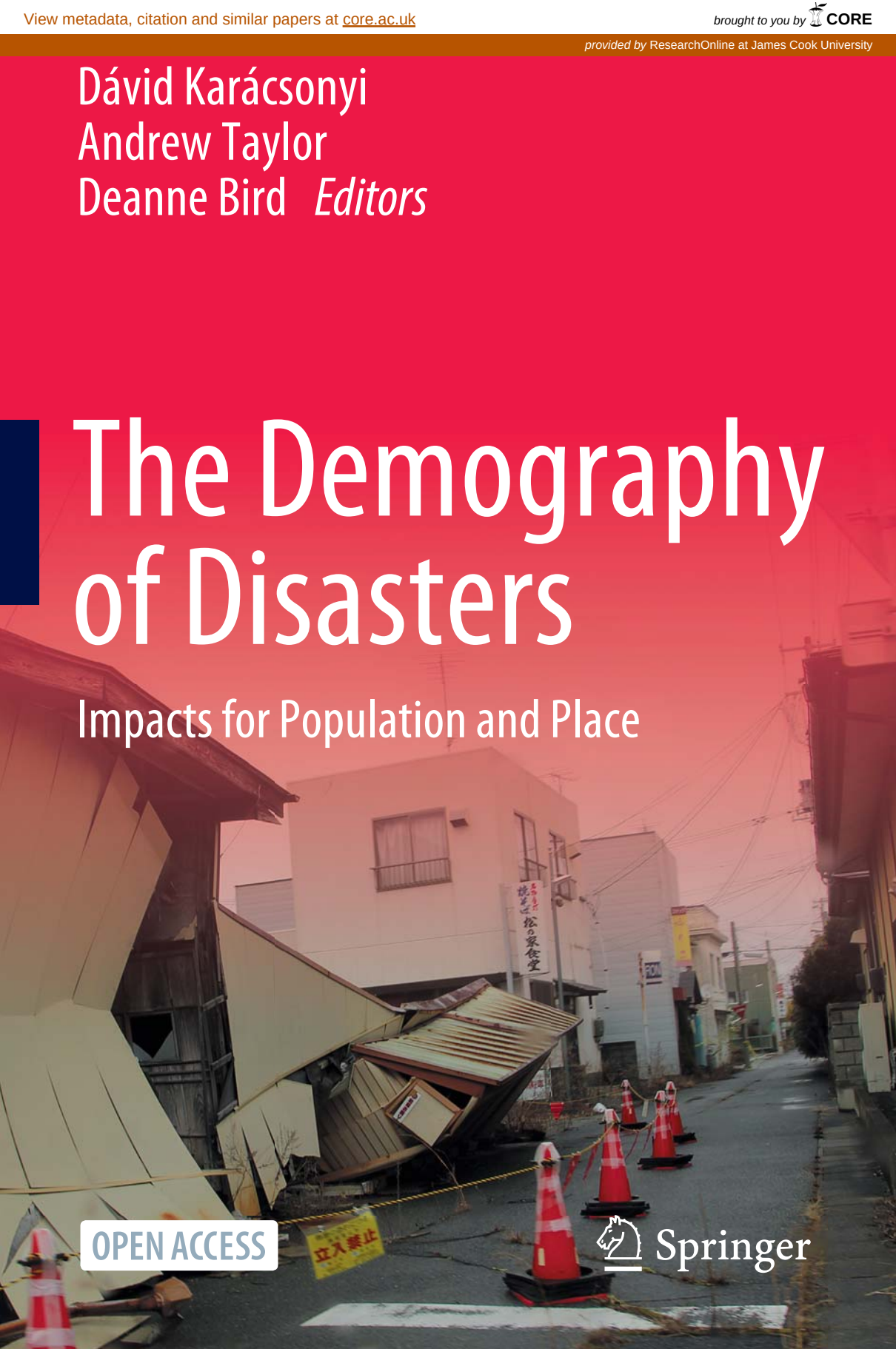
The Demography of Disasters

Impacts for Population and Place



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Chapter 6
Land Use Planning for Demographic Change After Disasters in New Orleans, Christchurch and Innisfail

David King and Yetta Gurtner

Abstract Land use planning is dominated by the growth paradigm—planning and development strategies of cities and regions to encompass increased demand for housing and infrastructure. Urban and Regional planning strategies are focused on enhancing development and growth to counter decline. In contrast, an emerging literature is concerned with planning for decline—managing population and infrastructure loss, decommissioning settlements and planning for reduced population and economy. The advent of a disaster is frequently a catalyst for local decline, but such loss is often connected to longer term issues and trends of population decline. New Orleans, Christchurch and Innisfail are examined in this chapter, to illustrate issues of population loss and demographic change against the impacts of specific disasters. The case studies exhibit multiple patterns of migration both spatially and temporally. Net migration has reflected population loss, but is not homogenous across the community. Specific demographic, cultural and socio-economic groups exhibited different patterns of migration and mobility. Reconstruction of such settlements faces changed demography with a shift in service and infrastructure needs. A reduced population requires land use rezoning, new strategic plans, land use change, removal of structures and re-siting of infrastructure while climate change related adaptation strategies identify protect, accommodate or retreat. Case studies illustrate various approaches to these issues.

Keywords Population loss · Land use · Planning · Urban planning · Regional planning · Disaster

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6.1 Introduction

Urban planning and regional planning are dominated by the growth paradigm, and while the growth of towns and cities have been driven by urbanisation from industrialisation alongside rapid population increase, there has also a demand for growth from businesses and industry. The influx of migrants into cities creates a demand for housing, services and infrastructure supplied by private and public sectors, and in turn creates jobs and economic activity. An increasing population boosts the market and creates a further opportunity for business expansion and profit. The private sector drives and invests in growth and thus demands policies and development strategies from all levels of government that enhance growth. Planning tools and concepts such as strategic planning schemes are frequently geared to growth. The positivist approach to city scaling (Bettencourt et al. 2007; Youn et al. 2016) shows that urban growth generates a value adding factor of about 15%, so that the effects of growth compound, creating both greater efficiencies and further growth.

While there is a "growth is good" paradigm "the key obstacle here is the notion … that a healthy city always grows in population and that only unhealthy ones shrink" (Hollander et al. 2009, p. 27). However, there are many conflicting messages in the literature regarding increasing urbanisation, including the speed with which cities have to absorb new migrants from rural areas, issues of city size, high density living, ecological impact, urban angst and alienation, inequality, social and economic divisions, social change, crime and pollution. Planners are faced with dealing with the negative aspects of cities, but work towards optimistic outcomes that rely on the drivers of growth to generate jobs and resources that contribute to solutions. Optimistic growth and modernism have been expressed most powerfully in the developing world where most urbanisation is presently occurring. In contrast, the developed world planning profession is increasingly faced with emerging trends of slow growth, environmental sustainability and population decline. Planning for shrinkage or population loss requires a significant re-thinking of urban and regional planning (Hollander et al. 2009). Newman (2006) critiques planning approaches based on population impact and ecological footprint, favouring a sustainability approach. A planning approach based on adverse local population impact is best tackled by a reduction in population and migration, which is not popular with governments or business as it runs directly counter to growth. Sustainability on the other hand encompasses both the positive impacts and opportunities of the city. Newman (2006) stresses the importance of sustainability in planning both for city growth and the scenario of stagnation or decline.

The reality of declining and disadvantaged regions is increasingly observed in towns and cities. Population migration and settlement relocation are part of adapting to a changing environment and economic opportunities. Alongside rapid urbanisation, there is a worldwide trend of shrinkage of cities, especially in the developed world (Oswalt et al. 2006; Hollander et al. 2009), where urban decline, inequity and social disadvantage are linked issues. Hollander et al. (2009, p. 223) claim that "developed, modern cities throughout the world are facing declines at an unprecedented

scale". Many medium- and small-sized cities below 500,000 population are shrinking while larger than these cities (in particularly global and mega cities) are rapidly growing (United Nations, Department of Economic and Social Affairs, Population Division 2018).

To an even greater extent than in city planning, regional planning has been concerned with economically disadvantaged or declining regions for many decades. Such areas are often characteristic of endemic rural poverty, remoteness, paucity of services and infrastructure, and areas of structural economic change as a consequence of post-industrial and resource change. A primary aim of regional economic development has been to arrest regional decline, initiate economic growth and in more recent decades, to adapt to changed social and economic realities through exploration of the strengths and opportunities of places to plan for new alternative economies and communities (Ehrenfeucht and Nelson 2011).

Hollander et al. (2009, p. 228) identify a broad range of processes which have led to demographic decline and change in both cities and regions. These include: suburbanisation and out migration, change in economic activity, post-industrial shift from manufacturing to service industries, war, fire, disease, agricultural crisis, an ageing population or low fertility rate, political changes that have shifted development and economic priorities and long-term subsidies, and perhaps most markedly impacts associated with significant natural or human induced disasters. A complicating factor of growth or decline is the failure of urban boundaries to shift as population moves out of city centres. The population of a city may show apparent decline while the broader peri-urban region may even have grown, or at least the decline may be much less overall. As populations exit the city for peripheral or peri-urban locations, they may also increase their vulnerability as they move into unfamiliar areas subject to different hazards.

In this chapter, we specifically address population decline of towns, cities and regions as a consequence of disasters. Population decline is not equal or evenly spread, but is expressed through different demographic indicators—ethnicity, socio-economic status, age and gender for example. Evacuation is an immediate response to a hazard, with a gradual return of some of the population during the recovery period, possibly over many years. This period of dislocation and population loss is an opportunity to re-appraise planning priorities—to plan and manage for a different community (see also Chapter 2). We explore these planning and demographic concepts and issues through an examination of three places that have lost population following recent disasters; New Orleans in the USA, Christchurch in New Zealand and Innisfail in Australia. The chapter examines theoretical aspects of planning for decline, the demographic impacts of disasters with emphasis on the three case studies and planning strategies and approaches.

6.2 Planned Decline, Planning for Decline and Disaster Recovery

The concept of shrinkage, shrinking cities (Martinez-Fernandez et al. 2016) and decline with consequent loss of population and services is an emerging trend in planning. As planning tools are geared to growth, shrinkage requires a re-thinking of planning. Hollander et al. (2009) recommend a paradigm shift to proactively plan for shrinkage—where shrinking cities sounds better than urban decline. An alternative expression might be "rightsizing"—planning for a different size and composition of community. Hollander et al. (2009) advocate that the appropriate planning response is to re visualise the city—to bring about smaller, less dense, redesigned cities that continue to be productive and sustainable. Shrinkage brings a range of issues including; land use and vacant land, reduction and/or decommissioning of infrastructure, cleaning and greening for maintenance of land values, redevelopment and revised landscape options, persistence of cultural attractions, historic preservation and social equity issues.

Shrinking cities, however, are not necessarily in absolute decline. Shrinkage creates a redefined density with the opportunity for nodes of redevelopment. Such strategies may include: environmental mitigation and ecological restoration, revegetation, stormwater and hazard management through vacant land, community gardens ("the new ruralism", Ellis and Fanning 1977), urban agriculture, mixed used redevelopment, tourism, temporary use initiatives such as retail exhibitions, urban installations and street markets, media/industry investments and recreation. Planners are in a unique position to reframe decline as an opportunity, a chance to re-envision cities and to explore non-traditional approaches to growth, liveability and safety (Hollander et al. 2009). A positive "sense of place" and resilience for a locality are especially significant after a major disaster.

Planning and management in the post-disaster recovery context represents another emerging area of planning research and policy (Olshansky and Chang 2009; Blanco and Alberti 2009). Planners play a critical role in the redevelopment of an area after an event with unique time-sensitive challenges regarding reconstruction and recovery of housing and infrastructure and social, economic and environmental systems. Specific issues include resource availability, public interest (with particular concern regarding speed versus quality) and opportunities for community betterment.

Olshansky and Chang (2006, p. 201) assert, "However defined, it is clear that post-disaster recovery demands the skills of planners. Recovery is a microcosm of all the challenges of urban planning—developing land use and economic development strategies to improve lives, acting in the absence of sufficient information, making trade-offs between deliberation and expediency, navigating local politics, engaging the public and identifying funding sources to supplement inadequate local resources." The reimagining of the reduced city enables planners to re-address the physical vulnerabilities of cities, polarisation, re-urbanisation, sense of place, mixed use redevelopment, social equity and quality of life—to incorporate new urbanist principles, to create liveable cities, resilient cities and climate change adaptation

through new approaches to land use change, zoning and integrated strategic planning (Hollander et al. 2009).

For environmental systems, large-scale depopulation with reduction and decommissioning of infrastructure allows for the removal of buildings and paved surfaces from floodplains, with enhanced opportunities for green urbanism, environmental mitigation and ecological restoration, green spaces for reforestation with environmental functions, watersheds (storm water management), wildlife habitats and the establishment of concentrated areas of vegetation to improve air quality and reduce urban heat-island effects. Socially and economically, a decreased population size and density post-disaster may facilitate a revised community focus, redistribution of resources and access, new social and community networking opportunities, diversified employment prospects and the development of enhanced resilience, safety and well-being.

The resized city requires strategic sustainable planning through positive de-densification (purchase of empty spaces and maintenance of adjoining blocks), demolition or re-purpose demolition of benign neglect, stabilisation of transitional cities and neighbourhoods for a sustainable future. Planning concepts require sustainable redevelopment, planning for a radically altered future alongside the uncertainty of climate change scenarios impacts. Enablers are participatory processes, local leadership, cooperation all levels of government, external funds and resources, pre-existing planning documents and institutions, with engagement and consensus on policies regarding future development (Hollander et al. 2009).

6.3 Shrinkage and Out Migration

While the growth paradigm remains popular, it is widely acknowledged by planners that cities, towns and regions lose population and may experience a consequent decline in economic opportunities, service provision and community resilience. Migration is a fundamental human characteristic. It is a rational response to changing resources, threats and opportunities. People are mobile over time and space. For the individual, out migrant relocation may enhance resilience and quality of life, although it may not necessarily reduce vulnerability factors. For the community that loses population to emigration, the process may reduce resilience and adaptive capacity and may increase overall vulnerability to economic and social change, including future disasters brought on by natural hazards and climate change. Emigration is highly significant for disaster risk reduction, although there is limited social science research literature or systematic data which estimates the impact of disasters upon population flows post-disaster (Love 2011).

Sociological disaster research predominantly investigates the recovery of social units such as individuals, family and households, organisations and community within the context of social networks, systems and institutions (Boon et al. 2012, 2013, 2016). Economic impacts further encompass businesses, economic costs (short term rather than long term), economic security and capacity, insurance coverage,

finance, employment and livelihoods. Physical destruction and damage to the built environment consequent to a disaster generally connects facets such as logistics, resources, lifelines, critical infrastructure (see Chap. 10), housing and basic service provision, environment and revised policy. Despite the significant implications for changed communities and regions, there is limited literature on planning for recovery and reconstruction, being focused more on mitigation of risks for an existing population, rather than being concerned with the absent or diaspora population.

Additionally, disaster driven out migration takes place within a context of the pre-existing processes of net migration. Disasters increase out migration, but in the long term, it occurs within the pre-disaster economic trend (see also Chap. 5, the case of Katherine flooding). There are five types of out migration processes that are enhanced by a disaster.

(1) Fear of risk and a consequent preparedness to leave the place to seek residence elsewhere (King et al. 2014). This is based on hazard vulnerability and perception of vulnerability by the individual or household, or business operation. Prior experience, or prior knowledge of the hazard in this place or others, influences an attitude of intent to move if threatened further. Age, local ownership of property, and economic capacity influence relocation capacity. Older people with local roots and property are much more constrained than younger economically active families, who cite safety of children as well as having a greater capacity to seek opportunities elsewhere (King et al. 2014). Disaster risk reduction for this population may put out migration as the most effective strategy and relocation may occur at any time prior to a hazard event occurring.
(2) Evacuation prior to a disaster where early warning is possible, such as for floods, cyclones and bushfires, is organised by authorities and emergency services and may be forced or advisory. This takes people out of harm's way and reduces the death rate, although the experience of severe bushfires has shown that voluntary evacuation which is left too late may significantly add to deaths. People may be accommodated temporarily and permitted to return soon after the danger has passed, but within the constraints of the extent of damage to the home community.
(3) Evacuation after an event has severely damaged a community, organised by authorities and emergency services and may be compulsory. Evacuation is usually a response to sudden onset disasters, such as earthquakes, where damage is widespread, secondary hazards pose a risk, and the community is unable to be supported through loss of housing, basic services and lifelines.
(4) Further evacuation from the impacted community or region progressively occurs as a consequence of the loss of structures, economy, services and infrastructure, making post-disaster recovery slow and inhibiting early return. Temporary accommodation nearby in anticipation of a rapid return becomes increasingly unviable, forcing people to move further away for work and accommodation.

(5) The longer term loss of economy and dwellings prompt emigration to places of greater opportunity where people may remain as they settle into a new community and lifestyle. Many of those initially displaced by advisory evacuations, accommodation loss and sustained damage choose this option.

In reviewing the demographic impacts of disasters, Love (2011) refers to populations in transition. While the long-term decline of a city is not necessarily a direct outcome of a significant high impact disaster, current research and literature indicate a period of population transition reflecting evacuations (voluntary and/or mandatory), residential damage, and displacement. Decisions to leave or return are highly dependent on the level of residential damage at localised geographical levels. Love (2011) identified that ninety per cent of residents return within 6 months, but if return does not occur within 2 years, it is likely to be permanent (see also Chaps. 2 and 11 on permanent resettlement). This is especially evident where there has been displacement of vulnerable populations from areas where they do not have the resources to recover. A concentration of vulnerable populations also occurs in areas where the better resourced were able to leave. Displacement as opposed to intentional out migration alters population dynamics, demographic composition and trends (Love 2011). Consequently, the people who leave and return to a disaster-impacted town or city are not a representative cross section of the population. In disrupting the functions and dynamics of pre-existing social systems, disasters distort social and demographic patterns.

As disaster rebuilding takes place in depopulated and changed physical and community landscapes, the critical issue emerges for planners of which infrastructure to rebuild, standards of improvement and best practice (Hollander et al. 2009, Ehrenfeucht and Nelson 2011). Comprehensive and strategic planning are crucially important in recovery as it is through land use planning and flexible rebuilding strategies that it is feasible to "build back better". Land is the basis of residential communities and economy, and thereby provides community security (Lundin 2011). There is an opportunity for change, urban transition, reconstruction and redevelopment—moving people away from direct physical exposure, thereby increasing mitigation and resilience rebuilding. These are priorities of the Sendai Framework—Disaster Risk Reduction (UNISDR 2015) and build back better (see Chap. 12)—and determined by how we conceive recovery and its narratives in recovery management decision making. Opportunities exist for planners to integrate New Urbanist principles (Congress for the New Urbanism 1999) into a resized urban landscape, driving land use change, development strategies encompassing considerations of economics, energy, transportation, sustainable development, well-being, social capital, resilience and liveability, as well as paying attention to climate change mitigation and adaptation in a greater future hazard risk environment.

6.4 Recovery and Loss Following Major Disasters: Case Studies

Since the new millennium, numerous towns and cities around the world have demonstrated population loss following a major disaster. This chapter proceeds to examine the experience of three disparate places from the perspectives of planning responses and disaster recovery. Population loss from each place is examined in the context of longer term demographic movements, with the disaster events extending these established trends.

Each of the three case studies is quite different, and as such, the aim of this review is not to make comparisons or contrasts, but rather to examine the direct experiences of urban places in the developed world that have had a notable decline in population following the impact of relatively recent disasters. New Orleans in Louisiana, USA, had an overall population of 1.34 million (Sastry 2009) before it was devastated by Hurricane Katrina in 2005. Christchurch City in the South Island of New Zealand with a pre-disaster population of 367,720 was severely damaged by two earthquakes in 2010 and 2011, with the latter quake causing more damage and significant loss of life (Love 2011). Innisfail and its Local Government Area of the Cassowary Coast in Far North Queensland, Australia, had a population of around 30,000 in 2011 (ABS 2016), and was hit by two category four cyclones—Cyclone Larry in 2006 and Cyclone Yasi in 2011. Although there was no loss of human life from either of these cyclone events, there was a compounding effect upon economic recovery.

Love (2011) stresses that the outmigration and movement of people after disaster events in Christchurch and New Orleans cannot be compared, proposing that Christchurch's experience is closer to the impact of Hurricane Andrew on Miami (1992), and the Kobe earthquake (1995). Likeswise Zaninetti and Colten (2012) compare New Orleans to the experience of Galveston, Texas after the category 4 hurricane[1] in 1900, following which economic and population growth shifted to Houston. Galveston was already in decline pre-1900. Both New Orleans and Innisfail experienced population stagnation and loss of economic importance over an extended period before the recent disasters, while Innisfail and Christchurch serve rural hinterlands, but these case studies are not otherwise comparable. They are presented as examples of different processes and experiences following disasters.

6.4.1 Christchurch

Christchurch city, the largest city on the New Zealand South Island, is renowned as a popular heritage tourism destination, surrounded by a peri-urban rural residential area (Swaffield 2012). Love (2011) refers to the widely cited figure of 70,000 overall population loss from Christchurch after the 2010–2011 earthquakes. An estimated

[1] According to the Saffir-Simpson scale hurricanes are scaled from 1 (min.) to 5 (max.). Category four usually means a maximum wind speed between 209–251 km/h.

Table 6.1 Population change in christchurch pre- and post-2010/2011 earthquakes (Newell et al. 2012)

		Waimakariri district	Christchurch city	Selwyn district	Greater christchurch
Estimated population	2006	44,060	361,820	35,000	440,860
	2011	48,600	367,720	41,100	457,420
Population change	2008–2009	800	3,700	1,100	5,600
	2009–2010	800	4,000	1,000	5,700
	2010–2011	900	−8,900	1,600	−6,500
Population change range scenarios 2011–2012*	Lowest outlier	400	−10,300	600	−9,300
	Low mid range	400	−7,900	900	−6,500
	Mid range	700	−4,700	1,200	−2,900
	High mid range	700	−2,800	1,200	−900
	Highest outlier	800	−700	1,300	1,400

*Estimates modelled by Newell et al. 2012

regional population of 460,000 in the Greater Christchurch area was affected, with 150,000 homes damaged to varying degrees. There was actually little population change after the 2010 quake, but damage from the 2011 quake resulted in a significant outflow and relocation (Parker and Steenkamp 2012). Newell et al. (2012) show in Table 6.1 that the population loss after this event was particularly concentrated in the city while less damaged peri-urban areas appeared to increase in population.

Newell et al. (2012) estimate around 15%, i.e., 55,000 of the Christchurch population left the city after the 2011 earthquake. Many Maori residents returned to traditional Iwi (Gawith 2011), but many who relocated a short distance subsequently returned in the short term. School enrolments in Christchurch (Newell et al. 2012) suggest less than 10% out migration occurred immediately post-quake with a steady population return. Gawith (2011) reviews a compilation of media reports on the Christchurch earthquakes, giving the media estimates of 26,000 people departing, and school rolls showing 4496 pupils having moved to new schools—partly driven by damage and closure of educational facilities. While the 2013 census shows that the population in Christchurch city was down 2% from 2006 estimates, the greater Christchurch region was estimated to have increased in population by 2.6% over this period (Statistics New Zealand 2014a). These census data also suggest that the highest rates of decline (35–36%) occurred in the most damaged areas with two-thirds of those displaced by the damage moving to another dwelling within the same territorial authority. Census data are not directly comparable to other population estimates, especially those of local governments and city councils. The 2018 New Zealand census estimated a 10% undercount, especially of Pacific Islanders, but only

a 2.4% undercount in 2013 (BERL 2018; Statistics New Zealand 2019; Statistics New Zealand 2014b).

Before the earthquakes of 2010 and 2011, the trend in Christchurch's population growth had been a continuous increase, predominantly through in migration, although it also had an ageing population (Love 2011). Newell (2012) places the observed out migration from Christchurch within a broader context of migration patterns of in and out migration and international arrivals, which show a marked decrease because of a loss of capacity for the tourism industry and related short-term visitor sectors, such as international students. A reduction of births was also observed. Building approvals, on the other hand, were highly robust from 2012, with the construction industry being a dominant driver of growth. The number of technicians and trade workers in the region increased by 6.9% from 2006 to 2013 in contrast to a national trend of decline in this labour force sector (Statistics New Zealand 2014a). Although the estimates of population out migration and return after the quakes appear highly variable, it is evident that the population loss from Christchurch was closely correlated with the extent of damage and loss of housing, services and infrastructure. Although the population dynamics have changed, the 2018 census indicates that the population has grown and by 2018, the census estimates that the population is around 404,600 (Statistics New Zealand 2019).

6.4.2 New Orleans

By comparison to Christchurch, the major US port city of New Orleans was experiencing long-term population and economic decline pre-Katrina (Love 2011). Love (2011) claims that New Orleans City had been noticeably declining since 1970, while Zaninetti and Colten (2012) assert that the history of New Orleans, known as The Crescent City or the Big Easy, has been one of declining importance since the American Civil War (early 1860s). The core city area reached a population peak of 627,525 in 1960 (Plyer 2011), followed by absolute population decline of this core city area and progressive expansion into the outer suburbs, encroaching on the surrounding protective wetlands and subsequently increasing the physical vulnerability to flooding. The population of greater New Orleans (metropolitan area) pre-event in 2005 was estimated at 1.34 million, of whom 69% identified as African-American (Sastry 2009). In the decades prior, the population declined 18% between 1970 and 2000 followed by a further 6% over the next 5 years. Unemployment rates were above the national average, over 20% were living below the poverty line in 2000, with high levels of socio-economic disadvantage (United States Census 2019; Simo 2008). In this context, Sastry (2009) suggests that many people who may already have been planning to leave the city for economic reasons may have been prompted by the Katrina evacuations. Katrina consequently accelerated demographic shifts.

With the impact of Hurricane Katrina in 2005 and the associated levee system failure, the entire New Orleans city centre population of 455,000 had to evacuate and resettle for over a month. There were at least 1500 recorded fatalities and more than

Table 6.2 Return rates to New Orleans post-Katrina (Fussel 2015; Love 2011)

Housing status	One year return percentage
Undamaged	96
Damaged but habitable	81
Uninhabitable	54
Destroyed	30

a million people were displaced within the broader region of impact. Approximately 71.5% of the 188,251 housing units in New Orleans were damaged, with 55.9% having major or severe damage (Fussell et al. 2010). Given the magnitude of this damage and the substantial drainage requirements, many evacuated residents ended up displaced for long periods of time. Four months after Katrina, the population of New Orleans was estimated at 158,353, a 64% loss on pre-Katrina numbers (Kates et al. 2006). Of 66,000 school students in New Orleans parish pre-Katrina, there were only 5000 by the end of the year. Most displaced students re-enrolled in other states (Sastry 2009).

With reconstruction and rebuilding slowed significantly by legal and property rights, provision of temporary accommodation, insurance, ecological restoration plans, race and other political issues all of which impacted people's return, the Census Bureau estimated the population of New Orleans at approximately 223,000 in July 2006—less than 50% of the pre-Katrina level (Zaninetti and Colten 2012). Fussell et al. (2010) calculated return rates against housing status one year after Hurricane Katrina (Table 6.2) suggesting an overall return rate of 70%, although other estimates were closer to 60%. Recovery of urban infrastructure, housing, businesses and services continued to be slow and highly variable. In 2010, a number of neighbourhoods that did not flood were near to 90—100% of their pre-Katrina population, if not exceeding. In contrast, vacancy rates across the entire city were approximately 25%, reflected in empty lots and abandoned homes, commercial and institutional buildings (Plyer 2011). The Data Center (Plyer 2015) states that ten years after Hurricane Katrina, New Orleans (city core area) had an estimated population of approximately 385,000, a net loss of 15%. Further analysis demonstrates the differential social, spatial and temporal population dimensions of recovery and the continued socio-demographic composition of vulnerability (Fussel 2015).

6.4.3 Innisfail

Innisfail, a small rural town in North Queensland, Australia, serves a surrounding agricultural population predominantly producing sugar, bananas and other tropical fruit crops. Historically the township has been significantly impacted by a number of cyclones. In 1918, a cyclone destroyed 1200 houses with 90 people killed. Of these fatalities, 37 people were specifically from Innisfail and 40–60 indigenous people were killed nearby (Boon et al. 2013). In 1986, Cyclone Winifred hit Innisfail

resulting in 3 deaths, 12 injuries and 200 people displaced (Boon et al. 2013). In this event, fifty homes were destroyed and a further 1500 buildings (95% of the town) were damaged resulting in insurance reparations totalling $65 million. Local media were running a historical remembrance of Winifred at the time Cyclone Larry hit in 2006.

Of the two category 4 cyclones[2] that recently devastated the area within a five year period, Cyclone Larry passed directly over Innisfail in March 2006 and Cyclone Yasi crossed near the small town of Mission Beach (50 km south of Innisfail) in February 2011, accompanied by a 5 m storm surge. Cyclone Larry caused the most physical destruction in Innisfail with over half the dwellings and infrastructure damaged. These damage rates were higher in older dwellings and in many of the surrounding townships. Cyclone Yasi destroyed approximately 150 homes, made 650 uninhabitable, with a further 2275 sustaining moderate damage across the entire impact area. No one died (directly from cyclone impact) in either event, and there were very few injuries. In both events, the direct impact on primary industry was devastating, losing hundreds of millions of dollars in damaged crops with consequent loss of employment and economic livelihoods. Insured damage from the whole region impacted by Cyclone Larry was estimated to be over $500 million dollars, while the damage from Cyclone Yasi five years later was estimated to be $3.5 billion (Boon et al. 2013).

Given a long period of ineffective local governance with economic weakness and instability, the rural shire of Innisfail reflected an extended population decline with an ageing population and out migration of younger residents. Stagnation of the tourism industry also led to a steady population decline in the wider Cassowary Coast region (Table 6.3). Both Cyclone Larry and Yasi occurred half a year before the 2006 and 2011 censuses. Many people were displaced with a significant number of agricultural employees without work by the time the formal censuses were undertaken. Despite the economic activity generated by cyclone recovery, the population of Cassowary Coast declined by 1.9% between 2001 and 2006 and a further 0.3% from 2006 to 2011. The trend of population decrease has continued in Innisfail since 2011 with both the township and Cassowary Coast declining by an overall rate of approximately 1.7% between 2001 and 2015.

6.5 Socio-Demographic Impacts of Disasters and Planning Strategies

Consistent with the finding of Love's review (2011), each of these case studies reveal populations in transition, characterised by obvious accelerated decline post-disaster event. Patterns of residents staying, leaving or returning have shown a strong correlation with the level of residential damage at the localised geographical level.

[2]According to the Saffir-Simpson scale. However Cyclone Yasi reached Category 5 according to the Australia-South Pacific tropical cyclone classification but was downgraded to Category 4 after landfall.

Table 6.3 Population change in Innisfail pre- and post-2006/2011 cyclones (Adapted from ABS 2016)

	As at 30 June	Innisfail cassowary coast (statistical area 3)	Innisfail (statistical area 2)
Estimated population	2001 (census)	35,408	9,719
	2005	35,203	9,822
	2006 (census)	34,711	9,664
	2010	34,921	9,627
	2011 (census)	34,718	9,576
	2015	34,820	9,556
Population change	2001–2006 (census)	−697 (−1.9%)	−55 (−0.6%)
	2005–2006 (TC Larry)	−492 (−1.4%)	−158 (−1.6%)
	2010–2011 (TC Yasi)	−203 (−0.6%)	−51 (−0.5%)
	2006–2011(census)	−101 (−0.3%)	−88 (−0.9%)
Total change	2001–2015	−588 (−1.7%)	−163 (−1.7%)

While the historical context and demographic circumstances were variable for each case study pre-event, there have been a number of socio-demographic factors and issues evident within the recovery process. Population movement during recovery and reconstruction has not been homogenous spatially, temporally or socially. Changes in gender profiles, age structure, race and ethnicity, employment, income, livelihoods, insurance coverage, housing affordability, rebuilding and redevelopment, service provision and rehabilitation of the surrounding environment each have implications on measures of vulnerability and resilience to future events that should be taken into account in planning decision making.

Sub-national population estimates for Christchurch city in 2012 revealed a population decline of about 13,500 (3.6%) compared to pre-earthquake estimates, although the greater Christchurch region experienced a growth of 2.6% (Statistics New Zealand 2012; Statistics New Zealand 2014a, b). The net migration loss from the city was partly offset by natural increase yet there were some observed differences in both gender and age groups (Statistics New Zealand 2012; Newell et al. 2012). In the two years after the earthquake, there was a significant loss of women from the workforce, fewer young adults and a net outflow of children and their parents. The population continued to age with an increase in the number of people over 50, also indicating this cohort was less likely to have left Christchurch than people of other age groups. A significant number of those displaced by damage and destruction to the housing stock relocated in proximate suburban regions with the 2013 census showing a large increase in the percentage of workers now commuting to the city for employment. There was however an 81.1% increase in the number of unoccupied dwellings as a consequence of the earthquake, many of these "red-stickered" as unsafe for occupation (Statistics New Zealand 2014a).

In Greater Christchurch construction replaced manufacturing as the industry sector with the highest proportion of employment after the quakes, as the inflow of workers and extensive rebuilding activity helped the economy remain reasonably resilient. Retail and tourism were hit hardest, but insurance helped to buffer the economic impact (Parker and Steenkamp 2012). Reflecting the extensive level of destruction, there was a marked decrease in the number of workers in central Christchurch City. However with offsets in the south-west and near the airport there was no long-term change in overall employment rates between 2006 and 2013 censuses (Statistics New Zealand 2014a). Gawith (2011) lists many social, emotional, psychological, traumatic, economic and financial impacts, as well as a loss of places and community. Relocation was thus not just physical necessity but about moving forward. Greater Christchurch strategic planning was in place pre-earthquake, based on performance criteria that stressed sustainability (Swaffield 2012). Although recovery and rebuilding have been slow there is an optimism about the future of Christchurch. There is not an alternative central place in that region of New Zealand.

Even prior to the impact and devastation caused by Hurricane Katrina, the core city of New Orleans was a poor community associated with high levels of poverty, crime, illiteracy, inadequate basic services including health care and education, substandard housing stock and a lack economic opportunities. Sastry (2009) identified that 23% of the New Orleans population was below the poverty line, with a 35% poverty rate amongst African-Americans. Rental rates were high, with lower than national average rates of home ownership. The distribution of predominantly African-American and more socially and economically disadvantaged people were concentrated in low-lying areas that took the brunt of floods. There were consequently high levels of permanent displacement of people and many uninsured losses following Hurricane Katrina. The principally poor population lacked the finances or resources to rebuild (Zaninetti and Colten 2012). Raising houses on stilts was seen by planners as too expensive for a poor population.

The recovery process in New Orleans has further embedded distinct geographical patterns of social vulnerability. Zaninetti and Colten (2012) highlight a change in the city's ethnic landscape with differentiation in population distribution on class and racial lines. The city and metro area became more ethnically diverse; as African-American and white non-Hispanic populations declined in overall number, there was an increase in Hispanic and Asian residents (Plyer 2015). This was also an ageing population with a noticeable growth in the proportion of residents aged 65 and older. With the business and tourist centres relatively undamaged by the flooding, there has been a significant increase in property values and consequently the historic downtown has revealed gentrification and relative affluence. Recovery in other areas has reflected a temporal redistribution of population in clusters of settlements associated with less flood-prone neighbourhoods, the level of damage and extent of rebuilding.

The worst flooded areas have been characterised by depopulation with abandoned properties and blight rather than spatial contraction of the city and infrastructure. In 2012, vacancy still represented a loss of over 11% of the city, particularly a shrinkage

of the metropolitan area (Zaninetti and Colten 2012). Population growth and relocation in New Orleans has moved from below sea level towards higher ground (vertical migration). Exposure to flood has been reduced since Katrina through population redistribution, but population loss has also reduced the tax base and capacity of the city to provide services and infrastructure. High demand and high rental costs for viable dwellings have made much of post-Katrina housing unaffordable. The reality of post-Katrina New Orleans is the emergence of unequal and disparate cities—the downtown cultural and business areas which have recovered, middle-class neighbourhoods which reflect variable degrees of redevelopment and recovery, and the disadvantaged areas (Olshansky 2006).

While continued population stagnation and decline in both Innisfail and Cassowary Coast reflect an established demographic trend, patterns over the last ten years have been underscored by significant reduction in standards of living. During the period 2001 to 2006, incomes grew faster than rents and mortgage repayments, but in the second half of the decade post-Cyclone Larry and accompanying the global recession and Cyclone Yasi, the reverse has been the case with housing costs increasing at much higher rates than household income, generating concerns regarding affordability (Boon et al. 2013). As redevelopment and rebuilding post-disaster resulted in an increase in housing approvals and the overall number of available dwellings, vacancy rates have also escalated.

Despite the influx of trades, technicians and the temporary construction boom associated with cyclone recovery, young people and families have continued to move to larger cities seeking education and employment opportunities. Numbers of youth and residents aged 25–44 declined by 1.8% with a distinct decline (10%) in couples with children and family household compositions. Reflecting an aging population the percentage of residents aged over 55 is increasing (see Chap. 2 for comparison on disaster-induced aging). The median age in Innisfail has subsequently increased by 7.2 years to 42.4 between the 2005 and 2011 censuses (QGSO 2017). With net population loss, there has been a reduction in both business and job prospects in the Innisfail township.

Growth and decline in coastal Queensland, including the Cassowary Shire remain heavily influenced by resource exploitation. Tropical fruits and sugar cane have declined in terms of relative commodity prices. Farmers are ageing, and the families of many have left the area to seek qualifications and off-farm careers. On top of these longer term trends, hazard events are major drivers of community change. The Cassowary Coast has 9.4% of its population Indigenous and experiences high population mobility, with 44% of the population of the local government area in the lowest *Socio-Economic Indexes for Areas* (SEIFA) quintile. Similar to the Maori of Christchurch (Gawith 2011), aboriginal farm workers and banana packers in Cassowary Shire found themselves put out of work following Larry and Yasi, returning to their home communities on Cape York Peninsula between 400 and 1000 km to the north.

Many other seasonal farm workers in the region were backpacker tourists who also lost opportunities in the shire and ceased to travel in this area. Tourism was hard hit generally, with resorts going out of business or into “moth balls”, or operating

part time, seasonally or for booked events. For many potential tourists, the stigma and perception of a disaster afflicted environment, and infrastructure preserved well beyond its useful life—the tourism industry has been slow to recover. Within this context of recurrent cyclones, flooding and coastal hazards, population loss and economic insecurity the Cassowary Coast Regional Council has continued to pursue a strategic planning direction of growth based on recognition of Innisfail as the major regional activity centre, supported by value added agriculture and tourism (AECOM 2012).

6.5.1 Planning Approaches

While population adjustment is fundamental to human response to disasters, population redistribution is a part of adaptation. In the aftermath of a disaster event, there are significant concerns regarding the prospect of sustained population exodus from a town or city. Task forces consisting of government representatives, planners, non-government organisations, industry and community members are often established to develop strategic approaches to arrest further population flight and facilitate reconstruction, resettlement and recovery. Strategies may be protective, defensive, offensive, opportunistic, or landscape and urban design oriented with different resource orientations (Lima and Eischeid 2017).

Planning for effective post-disaster recovery requires all scales and levels of government and a vision and openness to imagine a radically different, new community or city. Similarly, it is necessary to recognise patterns of demographic change and transition that may represent short, medium or even longer term population loss (King et al. 2016). There is a need for data and resource sharing and extensive communication. Recovery has to involve the diaspora population and planning for recovery needs funding (Olshansky 2006). Rather than traditional planning premised on anticipated future growth and development, post-disaster recovery should be prepared to plan-to-scale or right sizing for greater resilience and sustainability. Hollander et al. (2009) identify a number of strategies for "shrinking cities" or depopulated areas including de-densification, use of vacant land and underused property, green urbanism and environmental improvement, historic preservation and redistribution of access and resources aimed at enhancing equity, liveability, safety and sustainability. A number of these strategies are evidenced in the case studies.

Primary responsibility for planning for the recovery and revitalisation of Christchurch was given to the Canterbury Earthquake Recovery Authority (CERA). The main objective of this group was to strategically manage issues of centralisation, land use and infrastructure in the recovery process with an appreciation of potential future seismic activity and climate change considerations including floods, storms and sea-level rise (Miles et al. 2014). Given the high levels of damage and destruction in the CBD precinct, the vision was based on decentralisation and changes in the peri-urban landscape (CERA 2015). This process imagined a greener, more compact, more accessible and safer central business district dominated by low-rise buildings.

Further to this was the plan for a green frame or buffer around the CBD that would blend in with the Avon River, to be developed as a corridor of parkland through the city—emphasising ecological restoration and environmentally sensitive transport, including a new light rail network, and connectivity of city through recreational pedestrian boardwalks and cycle lanes.

Priority activities within the initial recovery framework included restoration of critical infrastructure (particularly water and sewerage) and the residential land use hazard assessments for resettlement, relocation and rebuilding (Miles et al. 2014). Specific designations were informed by the changes in building codes and regulations, where code changes required different structural requirements for houses, especially for foundations. Recommendations also advocated lower urban density with dispersed and mixed use environments in neighbourhood centres (Chang et al. 2014; Swaffield 2012). Subsequent to the demolition and removal of damaged buildings in the CBD, many vacant gaps and gravel quadrants were creatively inhabited by both temporary and permanent art installations, cultural activities, entertainment, open space, recreation and public areas including weekly street markets and even a retail mall made from shipping containers.

Five years after the 2011 quake, formal planning and ideas progressively transitioned from recovery to regeneration with the new Master Plan focused on urban renewal and development (CERA 2015). This plan promotes a vibrant, attractive, resilient city, with abundant open space and themed districts supporting restaurants, small shops and cafes, music, sports and recreation to stimulate business growth and economic activity. Restoration and maintenance of iconic historic buildings has been similarly supported to reinvigorate tourism and help re-establish a sense of place for residents. Despite the extensive rhetoric of building back residential dwellings and commercial premises more sustainably utilising green options, there was no legislation to enforce building "green" and insurance payments limited owners to like-for-like (with due consideration to new codes) (Miles et al. 2014). Businesses, services and populations have progressively returned to a revitalised more resilient region but the new strategic direction still appears to be dominated by top-down leadership and planning directives rather than a participatory process with consideration of resident aspirations (Chang et al. 2014). A subsequent earthquake affecting Christchurch in February 2016 recorded limited physical damage in the city, but the extent of psychological impact on an already traumatised and recovering community has yet to be fully appreciated.

Even prior to the impact of Hurricane Katrina, the parish of New Orleans lacked a strong history of traditional urban planning practice (Collins 2015). In the destruction and confusion post-event residents and displaced populations were confronted with a diversity of highly conflicting proposals ranging from campaigns to build back "bigger and better" to complete abandonment of the city (Olshansky 2006). Given the historical, cultural and symbolic significance of New Orleans, it was imperative for the community to rebuild and recover. The simultaneous emergence of differing city wide and neighbourhood plans from organisations such as the Federal Emergency Management Agency (FEMA), the Louisiana Recovery Authority (LRA), and various not for profit community groups did little to address the immediate demand

for permanent dwellings, basic services and critical infrastructure (Collins 2015). Kates et al. (2006) observed very slow and inadequate reconstruction and recovery processes that were influenced by race, class and government incompetence.

Integral to any effective plan for population return and resettlement was the resolution of the complexities and conflicts regarding a comprehensive land use and zoning process. Ehrenfeucht and Nelson (2011) identified a range of strategies relating to targeted investment and consolidation; restoration of the natural protective wetlands and environmental quality, alternatives for underused areas; mechanisms to maintain or reintegrate abandoned parcels; plans for infrastructure and service provision, and interventions to address issues of social inequality. However most lacked wholesale community and political support, sufficient funding and resources and activities were highly sporadic and ad hoc.

The recovery of New Orleans was primarily resident driven, but the rebuilding of houses and reconstruction of levees achieved replacement rather than building better structures that reduce future disaster risks. Increased physical vulnerability of New Orleans to flood risk is seen by Zaninetti and Colten (2012) as "maladaptive evolution caused by planning" (p. 680). Collins (2015) suggests that the first five years post-Katrina were focused almost entirely on recovery, the next five years were taken up with resolving the complex zoning processes with the eventual development and adoption of The *Plan for the twenty-first Century,* (commonly referred to as the Master Plan); a City Charter-mandated planning framework that shapes New Orleans' physical, social, environmental and economic future. This master plan reflects the values and priorities of liveability, opportunity and sustainability that emerged through a participatory community decision making process (Collins 2015). However, it fails to adequately address vulnerability and hazard resilience.

In terms of population size and the scale of destruction to buildings, infrastructure and services, recovery for Innisfail and the Cassowary Coast post-cyclone events was significantly smaller and less resource intensive than either the Christchurch and New Orleans case studies. However for the community and residents of this region, effective planning strategies were equally as significant to lifestyle, livelihoods, economic viability and decisions to persevere or migrate to other locations. Following Cyclone Larry, the Operation Recovery Task Force was established through the Queensland Government to coordinate basic needs, rebuilding and planning priorities (Queensland Government 2007). After Cyclone Yasi, this responsibility was delegated to the Queensland Reconstruction Authority (QRA).

In both cases, regional planning strategies were aimed at protecting the character of local townships, limiting exposure to natural hazards, establishing long-term economic stability and maximising infrastructure and transport provision efficiencies (AECOM 2012). Equally, provision was made to protect, maintain and sustain the region's unique natural assets and environment through biodiversity conservation and coastal protection. Specific initiatives identified in the master plan for Innisfail included the intensification and renewal of its CBD within the existing footprint, the development of greenfield sites within the urban footprint, the inclusion of open space for public, cultural and community amenity, in fill development and increased density for established industrial zones, and industry sector reform based on diversification

opportunities, value added agriculture and technological innovation (AECOM 2012). While statistical population trends suggest small yet continued net out migration the Cassowary Coast Planning Scheme 2015 anticipates population growth, tourism and expanded industry development within the region.

6.6 Conclusion

The analysis of planning responses to disasters in these three case studies illustrate consistent issues such as the priority restoration of critical infrastructure: water, waste, utilities, transport (roads, bridges, rail), as well as challenges and contention concerning dwellings, business, industry, support services, schools, public transport, hospitals, heritage, and environment, and sustainability provisions such as the enhancement of active transport of walking and cycling (although these were a lower priority). Recovery was complicated by residential zoning, complex and challenging regulations, competing visions and directions, a lack of public participation and engagement, the issue of contested demolition and what to do with unused and vacant lands, and a plethora of complex issues around insurance and the lack of insurance amongst the poor, resources and funds. In the midst of these challenges, controversy surrounded priorities of quick reconstruction and return to some sort of normalcy as opposed to effective long-term processes and transparency in all recovery and reconstruction activities.

We can summarise some basic findings and implications.

- Disaster is often inevitably a component of long-term population trends.
- Planning for community recovery and stability may be aimed at smaller rather than larger settlements in the future.
- Adaptation may be geared towards smaller populations and an altered demographic and socio-economic structure.
- Planning policy of retreat—decommissioning structures, settlements and infrastructure.
- Changed land use patterns—consolidation and principles of New Urbanism.
- Building back better.
- Rezoning hazard-prone areas.
- Sustainable planning and resource use.

King et al. (2016) analysed strategies and policies in the UNISDR Global Assessment Review of the Hyogo framework and subsequent Sendai framework (Boon et al. 2016). Many of these strategies have been adopted at local government levels, and some are implemented as policies, but for local governments, especially the three case studies examined in this chapter, it is a work that is in progress. The urgency of the pressure to recover and rebuild pushes longer term strategic views to one side, but we see these emerging after the immediate recovery phase.

There is inevitably short- to medium-term population loss as many people temporarily move away from danger and the loss of services, infrastructure and

economic support. The return of this population has to be phased over a long period as the city is rebuilt, but a portion of this population may never return, or a different demographic or social group replaces some of those who have left. The challenge of recovery and adaptation is correctly identifying and anticipating this demographic change in order to adopt approaches that suit the altered settlement. Within this change are activities and strategies to build back better, and to enhance both resilience and sustainability. Planning responds to a primary paradigm of growth, but growth is not always ideal or desirable. Loss of population and corresponding services and infrastructure is not necessarily detrimental. It is clearly an opportunity for planners in envisioning new and altered places. The emerging concept is planning to scale, or right sizing, where there is a clear and accurate awareness and recognition of demographic change and transition that enables an appropriate and better place to emerge from disaster. The latest trend in urban design is placemaking, which within the last two years has been defined as a movement on a scale with, and complementary to New Urbanism (Kent 2019). Planners are responding enthusiastically to the ideas in placemaking as the movement incorporates many of the issues that we have noted in relation to the recovery of the three case study settlements, but with a stronger emphasis on people, place and ethical integration as the core of urban design and planning (Kent 2019; Eckenwiler 2016). Placemaking transcends recovery and demographic planning. If we approach the planning issues, identified in these case studies, of adaptation, retreat, the decommissioning of structures settlements and infrastructure, changed land use patterns, consolidation and principles of New Urbanism, building back better, rezoning hazard-prone areas and sustainable planning and resource use from a placemaking perspective where we put people at the centre of well designed good places, it will matter less whether the place is smaller or whether it is growing. The quality and good design of the post-disaster community is far more important than its demographic impacts or recovery.

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